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# AE THE ENGINEERING IN AGRICULTURE NEWSLETTER

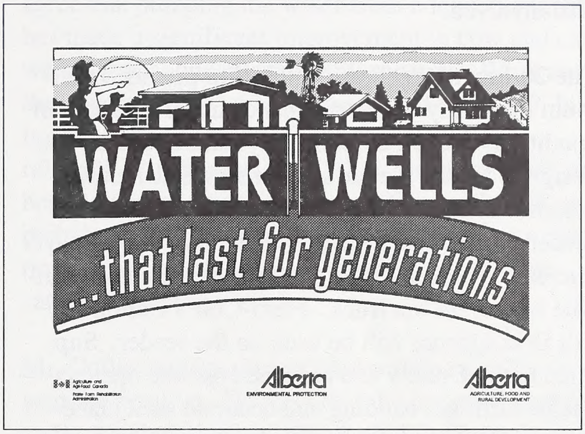
SPRING 1996

## Water Wells That Last

*Darcy Fitzgerald, Rural Water Agrologist, Edmonton*

With so many rural families and agri-businesses reliant on groundwater, a greater awareness is required if we are to sustain the water resources we have today. Approximately 90 percent of rural Albertans obtain their water from groundwater sources. The impact of poor well maintenance or groundwater contamination can have serious economic and health related implications. Rural development depends on good quality water.

As a result of these concerns, a water well information series has been developed by staff from Alberta Environmental Protection (AEP), Alberta Agriculture, Food and Rural Development (AAFRD), and the Prairie Farm Rehabilitation Administration (PFRA) of Agriculture and Agri-Food Canada. This on-going information development project entitled *Water Wells That Last* is an excellent example of how various agencies are working together to serve the public. Their goal is to increase public awareness for groundwater protection, water well maintenance, and promote a higher level of understanding prior to constructing a well. From this, well owners should be able to maintain a safe and secure water supply for many years.


WATER WELLS
...that last for generations
Agriculture and Agri-Food Canada
Prairie Farm Rehabilitation Administration
Alberta ENVIRONMENTAL PROTECTION
Alberta AGRICULTURE, FOOD AND RURAL DEVELOPMENT

*Water Wells That Last for Generations* is a 90-page manual that has just been released. It is a great reference source for information on groundwater, well construction, understanding present and future water needs, troubleshooting well problems, and understanding the importance of properly plugging unused wells. At present, three videos are available under the *Water Wells That Last* title from video libraries at AAFRD district offices and the central Multi-Media Library, PFRA district offices, and the AEP library in Edmonton. Topics covered include: planning and constructing a well, managing and maintaining a well, and methods for shock chlorinating wells.

Alberta
AGRICULTURE, FOOD AND
RURAL DEVELOPMENT
Engineering Services

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**The purpose of this newsletter** is to advise of activities and projects being conducted by Alberta Agriculture, Food and Rural Development's Engineering Services and Regional Agricultural Engineering staff. For further information on these projects and other engineering related activities contact:

| | | | |
|---|---|---|---|
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| Edmonton (Eng. Services) | 427-2181 | Lethbridge (AFMRC) | 329-1212 |

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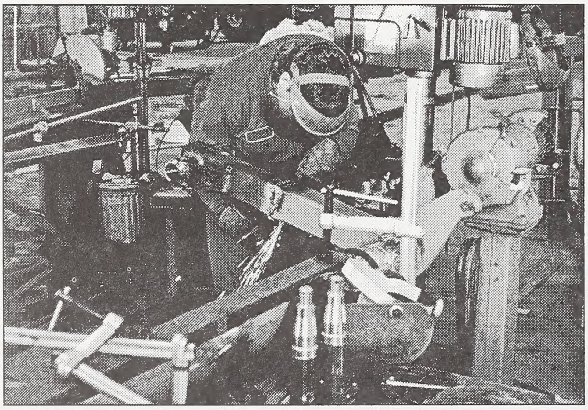
## Grass Seeder Being Developed

*Robert Maze, Project Engineer, AFMRC, Lethbridge*

Since 1990, the County of Forty Mile in southern Alberta has offered its ratepayers the use of a set of conservation tillage drills for seeding forages. To continue this very successful program, the County contracted the Alberta Farm Machinery Research Centre to help develop a prototype grass seeder. Flexi-Coil and CAESA (Canada - Alberta Environmentally Sustainable Agriculture Agreement) are also involved.

The 20-foot seeder was designed to provide maximum flexibility and performance under a variety of conditions. A self contained hydraulic system was designed for the seeder's pneumatic distribution system and transport hydraulics. This makes the seeder compatible with all of the County's ratepayer tractors. It was also designed to be easily transportable with a 3/4 ton truck. Flexi-Coil's Barton No Till Disk Opener will be used on the seeder. Supplied to the County at a reduced cost, the openers enable fertilizer banding and accurate seed placement for forage and grass seeds. Two Valmar tanks are mounted on the seeder frame for fertilizer and seed distribution.



Another component of the project involves the development of a standard test procedure for grass seeders. This will be used by County staff to determine the effectiveness of the unit in establishing forage and grass stands in a variety of conditions. The seeder will be available to farmers for spring seeding.

## Development of a Direct Shear Box Test Apparatus for Use in Predicting Soil Disturbance

*Vince Murray, Project Engineer, AFMRC, Lethbridge*

Research staff are currently involved in a weeds versus soil disturbance project. They are looking for a relationship between weed populations and soil disturbance.

One aspect of soil disturbance being examined is the volume of soil affected by the passage of a tillage tool. Several authors have attempted to predict the area of soil affected by modelling the soil-tool interaction in a variety of ways. Most models were based on earthmoving equations. Finite Element Analysis of the soil and ground tool interaction can predict the effects of simple tillage tools. One model, the "McKeys-Ali Method", achieves reasonable results for simple tillage tools without using finite analysis. This method requires knowledge of the cohesion and the coefficient of internal friction of the soil in order to predict the area on the soil surface that is disturbed. Cohesion and the internal friction angle of soil can be found by performing direct shear box tests.

A "Shear Box Test" consists of a slow, steady pull on a split box containing the soil sample. The equipment required is very expensive, so staff are attempting to build a suitable test device. This sample box will follow standards and be split into top and bottom halves. One half is pulled horizontally while the other is fixed. A vertical load is applied to the soil sample. As the box is pulled horizontally, the load required to shear the soil is recorded. Several runs are performed, each with a different vertical load. When the results are plotted, a cohesion and internal friction angle of the soil can be determined from the graph. This information will be used to determine if the McKeys-Ali Model can predict the area of soil disturbed by the more complex tillage tools used in our experiment. If so, mission accomplished.

# Pasture Water Quality and Cattle Performance

*Bob Buchanan, Regional Engineering Technologist, Barrhead*

During the summer of 1995, staff from Alberta Agriculture, Food and Rural Development along with the County of Athabasca, worked on a pasture water project on the Stoney Creek Farm (owned by Mr. Wilbur Collin) near Athabasca, Alberta. Its purpose was to assess the impacts that pasture dugouts and water quality have on cattle performance.

The pasture project involved a comparison between cows and calves drinking directly from a dugout as opposed to a similar number drinking from a stock tank which is filled automatically from a fenced dugout. Results from the first year of study are as follows:

- A significant gain in weight was recorded by the 20 cows plus heifer calves drinking from the stock tank compared to those drinking directly from a dugout. (See table for details.)
- In three of the four water tests, the direct watering dugout had higher levels of coliform and faecal coliform bacterial.
- The direct watering dugout also had giardia (i.e. beaver fever) present in three of the four water tests. The fenced dugout contained no giardia.
- The general water chemistry of both dugouts was almost identical.
- The water quality in the fenced dugout was clearer and contained less algae than the direct watering dugout.

Although all the researchers involved in the project agree that pumping the water from a fenced dugout has made a significant improvement in cow and calf weight gains, one question still remains. What are the major factor(s) which cause the difference? Is it improved access to water or is it water quality related? With further research planned for 1996, we hope to answer these questions. This study will also include a more detailed assessment of grass production in the two pastures and the difference in the cattle themselves.

Mr. Collin is quite pleased that results from the first year are positive. He feels that the improvement in cattle weight gains has almost paid for the watering system in the first year.

**1995 Pasture Water Quality Study, Stoney Creek Farm - Athabasca**

**Animal Performance**

| | | Pastures | | |
|---|---|---|---|---|
| **Animal Type** | **Weights** | **Fenced Dugout with Stock Tank** | **Direct Watering From Dugout** | **Difference** |
| 20 Cows | Total Gain (lbs) | 174 | 128 | 46 lbs x 20 cows x $0.50/lb = $460 |
| | Gain/day (lbs) | 1.45 | 1.07 | 0.38 lbs/day |
| 20 Heifer Calves | Total Gain (lbs) | 281 | 267 | +14 lbs x 20 calves x $0.90/lb = $252 |
| | Gain/day (lbs) | 2.34 | 2.23 | 0.11 lbs/day |
| | | | | Total = $712 |

# AFMRC 1996 Research Program

*Lawrence Papworth, Project Engineer, AFMRC, Lethbridge*

The Alberta Farm Machinery Research Centre is embarking on a busy research program for 1996. Three new projects are on the agenda.

One study involves the application of manure to alfalfa. This project will investigate the effects spread cow manure and injected liquid manure have on alfalfa. Other experimental factors included are application timing and the rate of nitrogen. Cooperating in the project are the County of Lethbridge, the Engineering Agricultural Resource Management Team and the Irrigation Branch of AAFRD.

The effect of varying soil disturbances on weed growth and populations is the next step in the chain of research involving direct seeding. This long-term project has not been finalized, but other possible factors to be explored are fertilizer rates and cropping systems. The Soil and Crop Management Branch and Engineering Services Branch of AAFRD, Agriculture and Agri-Food Canada, the University of Alberta, Flexi-Coil, Westco, and the Counties of Forty Mile and Lethbridge are all participating.

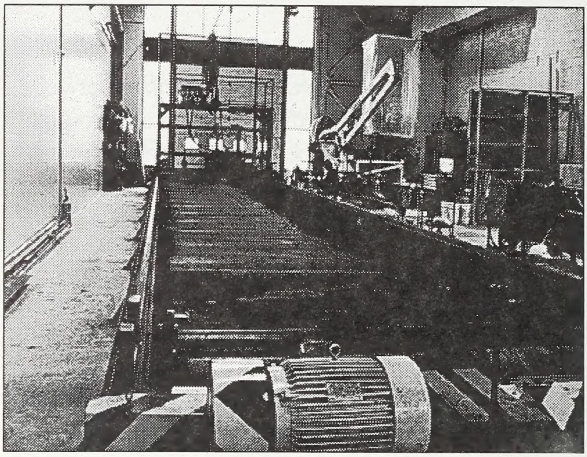
Work on the use of anhydrous ammonia while seeding will continue, but on a smaller scale compared to studies done in 1995. The project will investigate the effect of anhydrous ammonia form (liquid vs gas) on barley and canola yields. Urea fertilizer will also be compared to the anhydrous ammonia. Seeding and fertilizing methods along with fertilizer rates will be taken into consideration. Major cooperators in the project are Agrium Inc. and Bourgault.

The investigation of a method to harvest solid seeded beans will continue this year. Massey Ferguson will be providing a stripper header to modify and use.

# Busy Winter in Soil Bin

*Lawrence Papworth, Project Engineer, AFMRC, Lethbridge*

Engineering staff are currently wrapping up a busy winter in the Alberta Soil Bin Test Facility. Development projects for four manufacturers were completed during the first part of 1996. The projects ranged from development of new products to retesting of old ones.



The Centre assisted a farmer from the Wetaskiwin area with the development of a different type of packer. The Burr and Chain packing system consists of a slanted plate followed by a chain. The plate pushes soil over the seed and the chain breaks up the lumps and leaves the surface with a porous finish.

Seed boot spread pattern tests were conducted for Flexi-Coil. The purpose of these tests were to find the effect of variables on the spread pattern of air seeder boots. The variables tested included: seed type, air velocity, soil water, soil type, seed boot type and mounting. Flexi-Coil requested these tests due to the number of farmer complaints about narrow spread patterns last year.

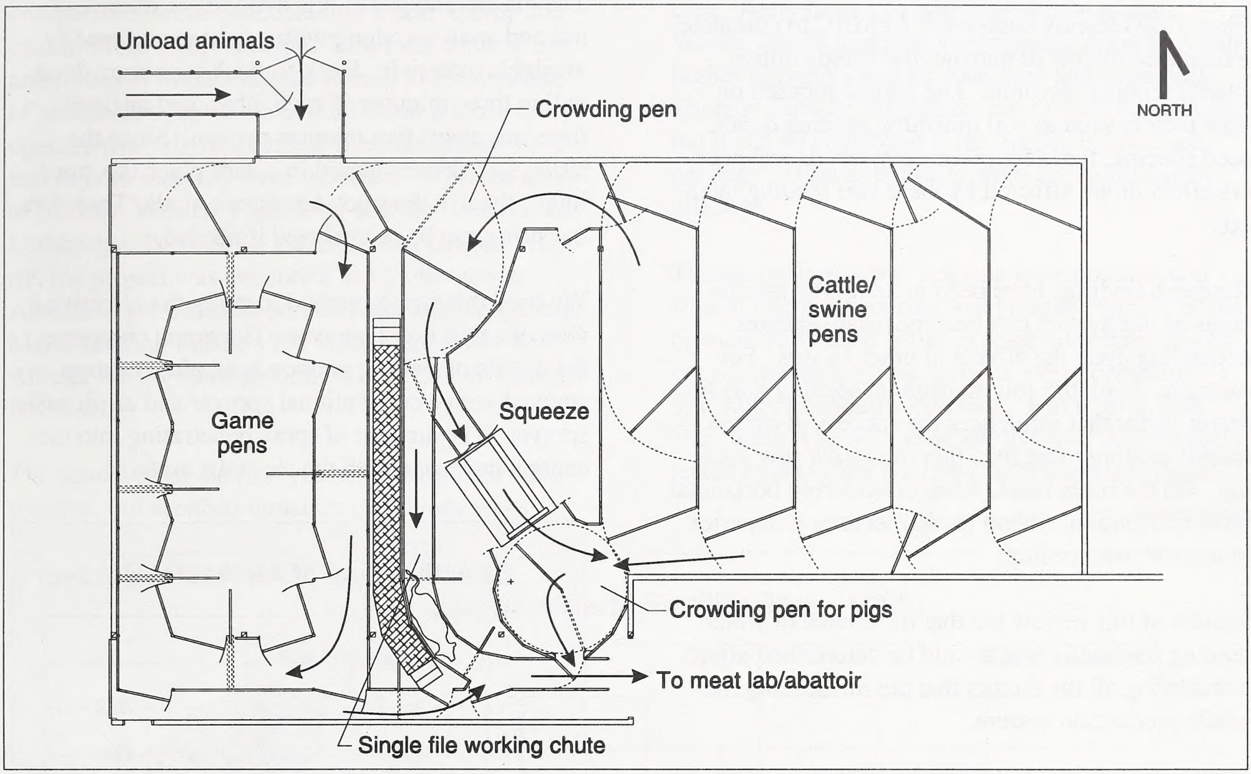
***We're on-line! Visit us at:***

*www.agric.gov.ab.ca/engineer/index.html*

# Designing the Animal Handling Facility for the Lacombe Meat Lab

*Robert Borg, Agricultural Engineer, Red Deer*

How do you design a facility for handling cattle, pigs, elk, deer, bison, ostriches, and emu? This was the challenge presented when the Lacombe Research Station wanted to renovate and expand the animal holding area for the meat quality lab. A flexible design was needed. The layout, shown in the diagram below, is the result of several design stages. Don Brereton, the meat lab facility manager, and Temple Grandin, livestock handling specialist also provided input. The original holding building was 40' x 50'. An addition expanded this space by another 40' x 40'. The new floor also provided another opportunity - to try out a hexagonal imprinted floor pattern developed at Silsoe in England. This pattern prevents animals from slipping on the concrete floor.



## Handling Area:

### Unload animals:

The animals can be unloaded by trailer or truck.

### Game pens:

The game pens have a central working area of 13' x 28' where the operator stands to observe the animals and operate the gates. When all the sliding gates are open, the animals can circle completely around the center area using the 5' alley around the perimeter. When sorting or handling elk, the sliding doors separate the alley into small pens. The pen walls consist of swinging gates which make a number of 5' x 5' pens possible.

### Cattle/swine pens:

These are multi-purpose pens (9' x 26') that can be divided in half with a center gate. Fourteen groups of animals are possible. The cattle can be worked down a 6' alley to the crowding pen, down the single file working chute, and either through a squeeze and back to the pens or directly to the meat lab abattoir area.

*(continued)*

An operator can follow along a raised walkway to the side of the single file chute.

Pigs are moved from the other end of the pen and through a crowding area using two 6' gates that pivot on a common center post, then into the meat lab.

## Narrow Row vs Ribbon Seeding

*Tracey Bolseng, Research Technologist, AFMRC, Lethbridge*

Flexi-Coil recently contracted AFMRC to complete a literature review of narrow row versus ribbon (band) seeding research. The review focused on how factors such as soil moisture, seeding depth, seed spacing, fertilizer placement, weeds and packers affect or are affected by these two seeding methods.

Research findings have been mixed. The advantages of one system can become disadvantages depending upon the effects of other factors. For example, available soil moisture at seeding may be a major factor that influences the success of ribbon (band) seeding more than that of narrow row seeding. On the other hand, when considering horizontal seed distribution, ribbon (band) seeding is superior to narrow row seeding.

Results of this review are that the choice of which seeding method is best should be determined after considering all the factors that are influencing the whole production system.

## Spray Measurements using the String Method

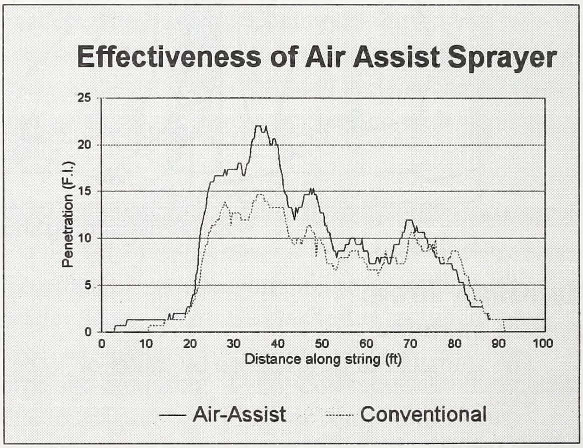
*Brian Storozynsky and Darryl Slingerland, AFMRC, Lethbridge*

Like everyone else, we are always on the lookout for ways to make our life a little easier. This past summer, we took another look at a spray measurement method introduced several years ago. The "String Method" has improved over the years and has now reached a stage where it might be useful in spray deposition research.

The "new" string method can be used to measure spray deposits, spray drift, and canopy penetration. For spray deposition or penetration measurements, a cotton string is stretched across the top and bottom of the crop canopy. For drift measurement, the string is set up vertically, downwind of the spray track. The spraying solution has a fluorescent dye mixed into it, and the string is analyzed with a fluoro-spectrophotometer that measures the fluorescent intensity (F.I.) of this dye on the string.

The big advantages of this method are its ease of use and analysis, along with its cheap and readily available materials. Back-to-back runs were done within three minutes of each other, and analysis time was about five minutes per run. Since the string samples are stored in a dark place (no sunlight), the dye does not deteriorate at all. Therefore, the string can be re-analyzed if needed.

We used this string method to study the effectiveness of an air assist sprayer. The graph compares the results of a string under a bean plant canopy sprayed with a conventional sprayer and an air assist sprayer. The amount of spray penetrating into the canopy increased with the air assist system.



In its current stage of development, the string method is already an improvement over other methods, saving time and money. The potential is there and, with a bit more development, the gains can be a lot greater!

# Direct Seeding With Anhydrous Ammonia

*Robert Maze, Project Engineer, AFMRC, Lethbridge*

Choosing the right double shoot opener for your direct seeding unit is not easy and it just got a little more complicated. Producers now have the option of using anhydrous ammonia while they seed.

A two-year study on the use of anhydrous ammonia at seeding had just been completed. Anhydrous ammonia and granular urea fertilizer placement comparisons were conducted on wheat, barley and canola while direct seeding. Test rates of urea and anhydrous ammonia ranged from 0 to 150 lbs/acre of actual nitrogen. Fourteen different double shoot openers were also compared; the emergence, yield and days to maturity were recorded. With the help of Sherritt, Westco, Flexi-Coil and the Counties of Lethbridge, Forty Mile, Camrose and Grande Prairie, the project was expanded to 12 sites across Alberta to get different soil and moisture conditions. Major funding for the 1995 work came from the Alberta Barley Commission and the Canola Council of Canada.

The results from the first year of testing were very positive, but seedbed moisture conditions were ideal. In 1995, seeding was conducted in very dry conditions in the Vermilion area and extremely wet conditions in Camrose. No major problems were detected, even at the 150 lbs/acre nitrogen rate. When comparing urea to anhydrous, the results did not show any significant difference in emergence, yield or crop maturity. However, yields using anhydrous were slightly lower than yields using urea. Anhydrous loss was probably to blame. Wheat, canola and barley emergence decreased with higher nitrogen rates for both urea and anhydrous. There is damage at fertilizer rates over 100 lbs/acre, but it can be controlled if the opener is managed properly. Days to maturity were not significantly affected.

The fourteen different openers were compared at sites at Barons, Camrose and Grande Prairie. Some openers performed better at some sites than others, but no one opener was better in every condition. The study included a side band, paired row, disk and sweep type double shoot openers. All openers tested could safely apply the anhydrous ammonia

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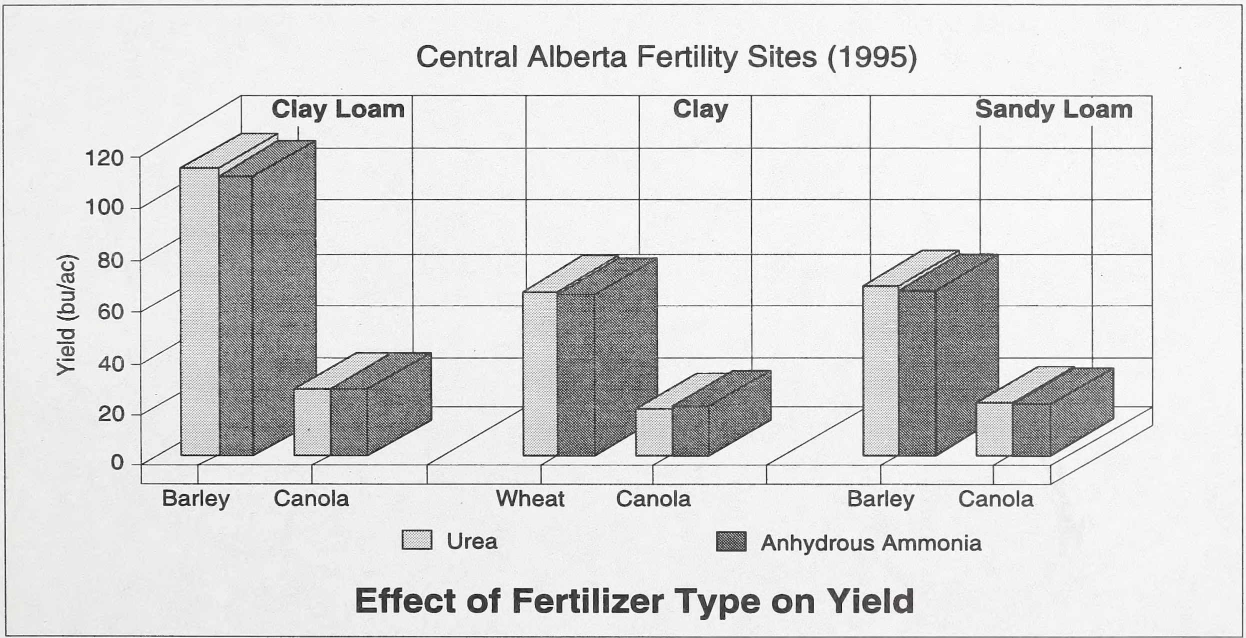

**Effect of Fertilizer Type on Yield**

and urea fertilizers without excessive damage to the seed. However, that does not mean that producers can use any opener to apply anhydrous. If seeds are placed above the anhydrous band they will probably die. To be safe, the opener should place the anhydrous and urea at least 4 cm horizontally from the seed row. Vertical separation from the seed is not critical, but the closer the anhydrous is placed to the soil surface the more likely it will be lost into the air. As part of the test, seed and fertilizer placements were measured for all openers.

If farmers are considering changing to anhydrous ammonia, there are benefits and drawbacks to consider. The benefits to anhydrous are that it is normally the cheapest source of nitrogen, requires less fill-ups than granular, and is usually delivered right to the seeder. On the negative side, safety is a major concern when using anhydrous ammonia. Frost and soil build up on the openers can also be a problem.

## Fencing with Electricity

*Brian Kennedy, Regional Engineer, Vermilion*

Electric fencing is a simple and effective alternative that keeps the cows at home. *Fencing with Electricity* is a new manual that has just been released by Alberta Agriculture, Food and Rural Development and is available from your local District Office or the Publications Branch.

Whether you are starting from scratch or electrifying an existing fence, this manual contains over 30 photos and colour illustrations to help you maximize the benefits of using electric fences. Wire configurations for every type of farm animal are covered, including effective predator control. Learn all about proper planning, components, fence safety and maintenance, and valuable troubleshooting techniques. Also included is a worksheet to help you design the solar powered system to suit your needs.

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## We Need Some Feedback

In an effort to better serve our readers, we would like you to take a few minutes to fill out the following questionnaire. Tell us your views, your likes, your dislikes. We welcome your comments!

Do you find this newsletter useful/interesting?

☐ Very useful/interesting
☐ Useful/interesting
☐ Not useful/interesting

From the topics listed below, which items interest you the most?

☐ Agricultural resource management
☐ Livestock
☐ Crops
☐ Farm machinery

Have you ever contacted any of the authors for additional information?

☐ Yes
☐ No

Are the articles presented in a clear and concise format?

☐ Yes
☐ No

Additional comments: (Technical content, presentation, readability, etc.)

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